DOCUMENT RESUME

ED 329 590 TM 016 248

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TITLE Dimensions of the Relationships between WISC-R Intellectual and Demographic Variables.
PUB DATE Aug 90
NOTE 11p.; Paper presented at the Annual Meeting of the American Psychological Association (98th, Boston, MA, August 10-14, 1990).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Children; Comprehension; Cultural Influences; *Demography; Elementary Education; *Elementary School Students; *Ethnicity; Factor Analysis; Intelligence Quotient; *Intelligence Tests; Multivariate Analysis; Perception; Predictor Variables; Regional Characteristics; Regression (Statistics); Sex Differences; *Socioeconomic Status; Test Validity; Verbal Ability
IDENTIFIERS Distractibility; General Factor (Intelligence); *Wechsler Intelligence Scale for Children (Revised)

ABSTRACT

The relationships between intellectual and demographic variables of the Wechsler Intelligence Scale for Children-Revised (WISC-R) were examined. Subjects were 2,200 children in the WISC-R standardization sample. Four multiple regression analyses were performed between Full Scale and Verbal Comprehension, Perceptual Organization, and Freedom from Distractibility (FFD) factor intelligence quotients (IQs) with 14 dichotomous demographic variables. Two canonical analyses were conducted between the demographic variables and sets of IQs and subtests, respectively. A general intelligence function, influenced by ethnicity, socioeconomic status, and region, was evident from both regression and canonical analyses. A weaker gender related attention dimension also emerged from the canonical analyses. The results provide a simultaneous multidimensional picture of the WISC-R intellectual and demographic variables and support the validity of the three factors suggested by A. S. Kaufman (1975), especially the FFD factor. Six tables present study data. (SLD)

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DIMENSIONS OF THE RELATIONSHIPS BETWEEN WISC-R INTELLECTUAL AND DEMOGRAPHIC VARIABLES

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Abstract

This study examined the relationships between intellectual and demographic variables of the WISC-R. First, four multiple regression analyses were performed between Full Scale and each of 3 factor IQs with 14 dichotomous demographic variables. Also, two canonical analyses were conducted between the demographic variables and sets of IQs and subtests, respectively. A "General Intellectual Function," influenced by ethnicity, SES, and region, was evident from both the regression and canonical analyses. A noteworthy, but weaker, "Gender Related Attention" dimension also emerged from the canonical analyses. This study supports findings from past research and brings to light some unexpected relationships.

Dimensions of the Relationships Between WISC-R Intellectual and Demographic Variables

The basic relationship between indices of intellectual functioning (i.e., Wechsler IQs) and demographic variables (e.g., sex, race, SES, etc.) has been firmly established by a growing body of literature (Barona & Chastain, 1986; Barona, Reynolds & Chastain, 1984; Kaufman, 1973; Kaufman & Doppelt, 1976; Reynolds & Gutkin, 1978; Sellers, Eickhoff, & Campbell, 1989; Wilson et al., 1978). However, to date, there has been only one study that has attempted an in-depth examination of these relationships in terms of their multiple dimensions (i.e., Chastain & Joe, 1987). Moreover, such an analysis has never been assayed with children. The purpose of the present paper was to examine the complex relationships between indices of children's intellectual functioning, as measured by the Wechsler Intelligence Scale for Children - Revised (WISC-R), and their demographic characteristics.

Method

Subjects

Subjects for the present study consisted of the 2200 children in the WISC-R standardization sample. The total sample was selected on the basis of random selection within stratifications on Sex, Race, Parental Occupation, Region of residence, and Urban versus Rural residence (Wechsler, 1974). To achieve a more detailed analysis, the Race, Parental Occupation, and Region of Residence variables were first transformed into 12 dichotomous variables. For example, the Region variable initially had four values (i.e., 1 to 4)

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corresponding to the four geographic regions of the United States. Each region was given its own dichotomous variable. That is, residence in the Western region, for instance, was assigned a value of "1," while non-residence in that region was assigned a value of "0." The Sex (Male=1, Female=0) and Urban/Rural (Urban=1, Rural=0) variables were already dichotomous. In addition, IQ values for the Full Scale and Kaufman's (1975) Verbal Comprehension (VC), Perceptual Organization (PO), and Freedom from Distractibility (FFD) factors were computed for each child. VC, PO, and FFD were selected rather than the familiar Verbal and Performance IQs because of the growing body of evidence supporting their preeminence (Gutkin, 1979, 1983).

Procedure

The study proceeded from single dimensional to multidimensional analyses in three steps. The SPSSx MANOVA program, with the DISCRIM subcommand (SPSS Inc., 1988), was used for all analyses. First, four multiple regression analyses were performed using the 14 demographic variables as predictors while the criterion variables were Full Scale, VC, PO, and FFD IQs, respectively. Correlations between each variable and the predicted criterion (structure coefficients) were then examined for each regression. Thompson & Borrello (1985) argue that structure coefficients tend to be more stable than regression coefficients in providing insight into multiple regression and canonical relationships. For the second step, a canonical correlation analysis was performed between the set of VC, PO, and FFD IQs, on the one hand, and the set of demographic variables on the other. The orthogonal canonical correlations were evaluated, and the structure coefficients (i.e. correlations between each variable and its corresponding canonical variate) and redundancy percentages (i.e., percentage of variability of canonical variate explained by opposite set's variability) for both sets were examined in order to identify the dimensions they seemed to describe. Finally, the third step was the most detailed and involved yet another canonical analysis, this time between the set of 11 WISC-R subtests and the demographic variables. Again, the orthogonal canonical correlations, structure coefficients and redundancies were examined for interpretation.

Results

Multiple Regression Analyses

The multiple regression analyses of Full, VC, PO, and FFD were completed and the results are shown on Table 1. Table 2 contains the structure coefficients for the demographic variables for each of the four regression analyses. All coefficients remained remarkably stable across the first three analyses. The coefficients for the White and Black ethnic variables, the Professional, Semiskilled and Unskilled SES variables, and the South region variable were the largest of the set in all four analyses.

Canonical Analysis between IQs and Demographics

The initial canonical analysis, using the three Factor IQ values and 14 demographic indicators, produced three significant ($p < .001$) canonical

correlations. These results are shown on Table 3. The first two canonical correlations, together, accounted for 96% of the common variance. Hence, only these first two dimensions were interpreted. Structure coefficients of these two dimensions are shown on Table 4.

The first dimension, which accounted for 78.6% of the common variance, may be interpreted as a "General Intellectual Function." That is, all three IQ variables correlated highly with their canonical variate, while the ethnic variable's of White (.75) and Black (-.76), the Parental Occupation variables of Professional (-.47), Semiskilled (-.36), and Unskilled (-.47), along with the South region variable (-.33) had the largest correlations with their canonical variate. Together, the IQ variables accounted for about 15.7% of the variance of the demographic variate. The demographic indicators accounted for 3.4% of the Intellectual variate.

The second dimension, which accounted for about 17% of the common variance, may be interpreted as a "Gender Related Attention" dimension. Here, the structure coefficient for FFD was by far the highest (.70) of the three IQ variables, while Sex (-.63) was the highest among demographic variables. The redundancies in the second dimension were 1.3% for the IQs and .57% for the demographics.

Canonical Analysis between Subtests and Demographics

The results of the canonical analysis between the 11 subtests and the 14 demographic variables revealed six significant ($p < .05$) canonical correlations. These results are shown in Table 5. Again, the first two canonical correlations, together, accounted for 82% of the common variance. The other four canonical correlations, combined, accounted for only about 10%. Because of this, and as before, only the first two dimensions were interpreted. Structure coefficients of these two dimensions are shown on Table 6.

Again, the first dimension was seen as a "General Intellectual Function." The structure coefficients of the demographic variables were quite similar to their counterparts in the first dimension of the previous analysis. All subtests had relatively high coefficients (i.e., > .35) except Coding and Digit Span. As in the previous analysis, White, Black, Skilled, Semiskilled, Unskilled, and South had the largest coefficients among the demographic set. The redundancies for the subtests and demographics were 10.1% and 3.5%, respectively.

The second dimension this time accounted for 30% of the common variance and again can be interpreted as a "Gender Related Attention" dimension. More specifically, Coding (-.81) and Digit Span (-.35) were the largest intellectual coefficients, while Sex (.89) was the only demographic coefficient to exceed .35. This is also consistent with the previous analysis, since Digit Span and Coding are two of the three subtests that make up the FFD factor. On this second dimension, the subtest and demographic indicators' redundancies were 1.4% and 1.3%, respectively.

Discussion

The single dimension analyses (i.e., multiple regressions) illustrate the strong similarities among the Full Scale, VC, PO, and FFD IQs in terms of their relationships with the demographic variables. That is, there were

consistent positive relationships between intellectual indices and high SES Whites living outside the South, and consistent negative relationships for low SES Southern Blacks. These were echoed by the large first dimensions of both canonical analyses. Taken together, these results support the frequently suggested concept of a robust General Intellectual factor measured by the WISC-R; albeit one that is influenced by ethnicity, SES, and geographic region.

The second dimension found by both canonical analyses, though not nearly as strong as the first, was somewhat unexpected. It was certainly not evident in the regression analyses. This dimension indicates that females generally tended to achieve higher FFD IQs than males. In this regard, the variability of the FFD IQs can be explained primarily by Coding, and to a lesser extent, the Digit Span subtest scores.

This methodology, particularly the canonical analyses, provided a simultaneous, multidimensional picture of the WISC-R intellectual and demographic variables. Also, it supports the validity of Kaufman's three factors, especially the FFD factor. Further, this examination shows the WISC-R to be a complex test that is differentially related in more than one way to a number of demographic characteristics.

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Table 1
Results of Regression Analyses
Between Dependent and Demographic Variables

Dependent Variable	R	F
Full Scale	.47474	57.87**
Verbal Comprehension	.46475	54.80**
Perceptual Organization	.42720	44.40**
Freedom from Distractibility	.34832	27.47**

Note: Degrees of Freedom = 2188 & 11 for each.
** = $p < .001$

Table 2
Structure Coefficients for
Demographic Variables in Four Regression Analyses

	Dependent Variable			
Demographic Variable	Full	VC	PO	FFD
Male/Female	.12347	.18925	.24882	-.22358
White Ethnicity	.75124	.71703	.78250	.56190
Black Ethnicity	-.76516	-.71054	-.82580	-.55749
Other Ethnicity	-.03617	-.09901	.05623	-.07538
Professional Parent	.48469	.51386	.35394	.56287
Managerial Parent	.27653	.28059	.23019	.25240
Skilled Parent	-.02674	-.02770	.02497	-.04464
Semi-Skilled Parent	-.37369	-.40483	-.27357	-.40067
Unskilled Parent	-.46570	-.45624	-.46507	-.45536
North East Region	.16830	.20513	.06165	.36734
North Central Region	.04522	.00171	.12776	-.02529
South Region	-.32993	-.30107	-.37724	-.32461
West Region	.16707	.14381	.24202	.02885
Urban/Rural Resident	.12622	.13279	.05592	.28206

Table 3
Results of Canonical Analysis
Between Factor IQs and Demographic Variables

Dimension	% Common Variance	% Shared Variance	% Redundancies: IQ Variables	% Redundancies: Demographic Variables	R
General Intellectual	78.576	23.798	15.797	3.412	.488**
Sex Related Attention	17.457	6.488	1.326	.569	.256**
Uninterpreted	3.967	1.552	.205	.128	.125**

** = p <.001

Table 4
Structure Coefficients for
Two Dimensions of Canonical Analyses

Variable	General Intellectual	Sex Related Attention
IQ Variables		
Verbal Comprehension	.94619	.16320
Perceptual Organization	.85330	-.31839
Freedom from Distractibility	.60663	.69650
Demographic Variables		
Male/Female	.20391	-.62568
White Ethnicity	.74938	-.18514
Black Ethnicity	-.76091	.25505
Other Ethnicity	-.04376	-.20781
Professional Parent	.46591	.38725
Managerial Parent	.26645	.08208
Skilled Parent	-.00948	-.10410
Semi-Skilled Parent	-.36407	-.25334
Unskilled Parent	-.46733	-.06516
North East Region	.16061	.46712
North Central Region	.04685	-.21859
South Region	-.33454	.02477
West Region	.17911	-.27590
Urban/Rural Resident	.11088	.34076

Table 5
Results of Canonical Analysis
Between WISC-R Subtests and Demographic Variables

Dimension	% Common Variance	% Shared Variance	% Redundancies: Subtest Variables	% Redundancies: Demographic Variables	R
General Intellectual	52.373	25.075	10.152	3.488	.501***
Sex Related Attention	30.065	16.116	1.410	1.305	.401***
Uninterpreted	7.706	4.693	.359	.448	.217***
Uninterpreted	2.944	1.847	.090	.172	.136***
Uninterpreted	2.664	1.674	.085	.152	.130**
Uninterpreted	2.452	1.542	.082	.138	.124*

*** = $p < .001$
** = $p < .01$
* = $p < .05$

Table 6
Structure Coefficients for
Two Dimensions of Canonical Analysis

Variable	General Intellectual	Sex Related Attention
Subtest Variables		
Information	.80985	.07518
Similarities	.70888	-.29047
Vocabulary	.80272	-.25525
Comprehension	.75962	-.23991
Arithmetic	.55956	-.18775
Digit Span	.36830	-.35359
Picture Completion	.59260	.04234
Picture Arrangement	.57382	-.09674
Block Design	.77771	-.09780
Object Assembly	.64665	.03964
Coding	.25648	-.80706
Mazes	.51063	.05923
Demographic Variables		
Male/Female	.33856	.88759
White Ethnicity	.73383	-.13376
Black Ethnicity	-.74417	.11645
Other Ethnicity	-.04596	.07097
Professional Parent	.43674	-.22442
Managerial Parent	.26845	-.14795
Skilled Parent	-.02795	-.00665
Semi-Skilled Parent	-.34084	.26796
Unskilled Parent	-.44024	.10890
North East Region	.13808	-.20963
North Central Region	.05542	.15094
South Region	-.32240	.09818
West Region	.17845	-.07315
Urban/Rural Resident	.08410	-.26860